DK-20029

CUBES, PRISMS, AND CYLINDERS

by Jason A. Dylan

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Activity Worksheets.....following the documentation

See the Special Features box
on page 1 for important
information about this program.

ABOUT THE AUTHOR

Jason A. Dylan was formerly a master mathematics teacher in the New York City Public School System, and has taught Mathematics Education at Fairleigh Dickinson University and William Paterson College. He is a former associate of the Madison Project at Syracuse University, and was a consultant and project associate to Teachers' College, Columbia University. A writer for the Central Iowa Low-Achievers Mathematics Project, he has written many texts and audio-visual packages in mathematics and science.

CUBES, PRISMS, AND CYLINDERS

SPECIAL FEATURES

Scale Option.....6
(to change the mastery level of the software)

Teacher Option.....7
(to allow direct access to all lessons)

OVERVIEW

This disk serves to introduce students to the concepts of surface area and volume, and demonstrates how to find those qualities for cubes, prisms, and cylinders. Through extensive use of graphics, students are familiarized with the number and relationships of the faces of cubes, rectangular prisms, triangular prisms, and cylinders. Techniques for finding surface area and volume for each of these figures are demonstrated, and plentiful practice and reinforcement are provided. Students are led to generalize toward universal solutions for finding surface area and volume of any regular prism. Finally, there is a practice program which permits the student to obtain reinforcement by finding surface area and volume for each solid — either individually, or in a computer-selected mix. All numbers in the tutorials as well as in the practice exercises are generated randomly within predefined ranges.

GRADE LEVELS

The materials on this disk are appropriate for students in grades 5-12 and G.E.D.

PERFORMANCE OBJECTIVES

After successfully completing all five lessons on this disk, students will be able to:

- identify cubes, prisms, and cylinders by their properties.
- state that surface area is the sum of the areas of all the faces of a solid and is expressed in square units.
- state that volume is the amount of three dimensional space that a figure contains and is expressed in cubic units.
- find the surface area and volume of cubes, rectangular prisms, triangular prisms, and cylinders.
- define the bases of a prism as those opposite, congruent faces that are not rectangular in shape.
- state that the volume of any prism can be found by multiplying the area of its base by its depth.

APPROXIMATE TIMINGS

Each lesson should take between 15 and 20 minutes to complete. Of course, the amount of time needed to complete each lesson will vary with the speed at which each student works.

TYPE OF LESSONS

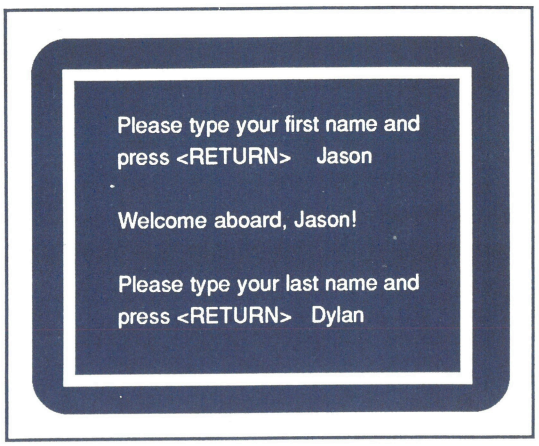
Four of the five lessons on the disk are tutorials which make use of high resolution graphics and animation. Each of these lessons contains internal reviews which reward correct answers and give detailed solutions for incorrect ones. Each of these lessons concludes with a quiz. The fifth lesson is a practice lesson which permits the student to exercise any and all of the skills gained from the previous lessons either one geometric shape at a time or all four types mixed.

PREREQUISITES

Students should be familiar with the algorithms for finding the areas of squares, rectangles, triangles, and circles, and the algorithms for finding the circumference of a circle.

HOW THE PROGRAM WORKS

When the program begins, the EA logo/title frame appears first. This is followed by a screen which asks the student to type in first and last names.



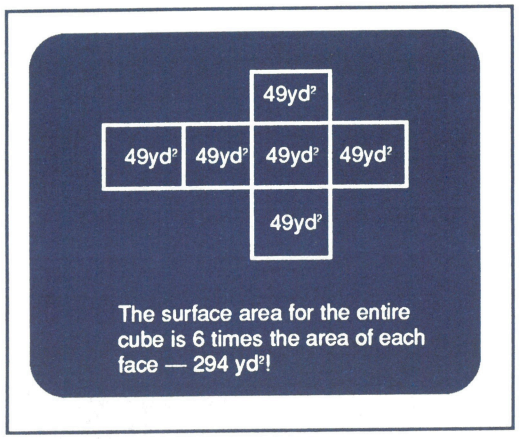
After a few seconds during which the computer checks and updates the management files, the computer will automatically begin the first program that the student has not yet successfully completed. (See Management System on page 5 for additional information about this feature.) If the student has already successfully completed all programs on the disk, the computer will acknowledge that fact and display a menu allowing the student to choose any program that s/he wishes to do. The choices will be:

1— Cubes
2— Rectangular Prisms
3— Triangular Prisms
4— Cylinders
5— Mixed Practice

While running the lessons, a flashing cursor in the lower right corner of the screen is a signal to the student to press the space bar to continue.

1 - Cubes

CUBES opens with a definition of a cube, and asks the student to tell how many faces it has. The cube then unfolds to display the six faces, each of which is a square. After the cube is reassembled, a dimension is displayed along one edge, and surface area is defined. The student is asked to compute the cube's surface area. An incorrect response will cause the cube to unfold. The area of each face is then displayed upon it and the student is told surface area is six times the area of one face. The fact that area and surface area are expressed in square units is emphasized.

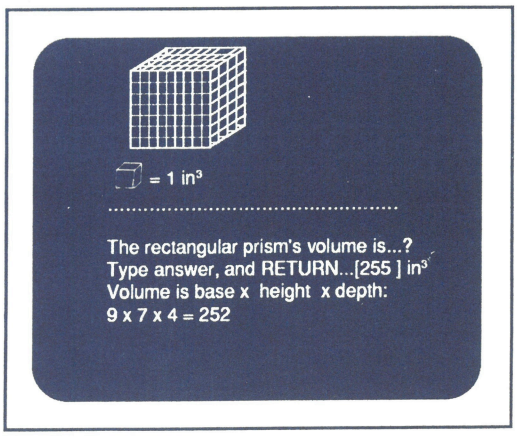


Following two practice exercises and an option to do a third, a new cube is displayed with a smaller unit cube beside it. The student is asked to guess how many unit cubes will fit into the larger cube. The large cube is then filled with unit cubes, and the student is encouraged to count them.

A second such exercise leads to the introduction of the term "volume" and the notion of cubic measure is explored. The volume of a cube is then defined as computable by base times height times depth or as "side cubed." Exercises follow with units being randomly chosen from traditional and metric types. A random set of five review questions concludes the lesson.

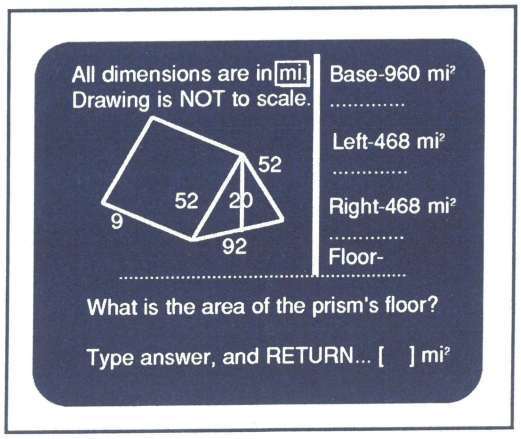
2 - Rectangular Prisms

RECTANGULAR PRISMS follows very closely the pattern established in CUBES. The only essential differences are the formula, volume = side cubed, is no longer applicable, and the graphics are all proportional to the dimensions of the prisms being solved. Additionally, the student solves for the areas of each pair of opposite sides before adding them together to find the surface area. Five random multiple-part questions requiring solutions conclude the lesson.



3 - Triangular Prisms

Like the two lessons preceding it, TRIANGULAR PRISMS unfolds one of the graphics to demonstrate the components of its surface area. Like the preceding lesson, the areas of all faces are computed before the student goes on to compute surface area. To explain volume, a rectangular prism is drawn about the triangular prism. It is then noted that the triangular prism's volume is 1/ 2 that of the rectangular one. An alternative solution is then shown, namely finding the area of the base and multiplying by the depth. Base is defined here as the two opposite congruent faces that are not rectangles (obviously this is a definition not useful for rectangular prisms). Students are then encouraged to generalize the fact that the volume of any prism may be found by multiplying the area of the base by the depth. Random multiple-part questions conclude the lesson.



4 - Cylinders

CYLINDERS are demonstrated to be merely odd prisms when it comes to computing surface area and volume. A graphic of a cylinder is turned on end, and the top and bottom separated. The cylinder is then unrolled to demonstrate that for purposes of finding its surface area. The figure consists of two circles and one rectangle whose length is the cylinder's depth and whose width is the cylinder's circumference. Volume is found using the generalization developed in the previous lesson, namely: find the area of the base (a circle in this case) and multiply by the depth. As with the previous lessons, a short quiz with multiple-part questions concludes the lesson.

We can now clearly see that, disassembled, the cylinder's surface area comprises 3 faces:
Two of those faces are circular, and one is rectangular!

5 - Mixed Practice

This part of the program affords the student an opportunity to further fine-tune his/her skills. The menu permits the student to select any one of the four figures previously dealt with, or a mix of all four. Sets of five problems are generated, and the student may opt to do up to five such sets at a time. The score achieved on the last set attempted is stored on the disk.

MANAGEMENT SYSTEM

How It Works

The lessons on this disk are meant to be used sequentially by the students. For that purpose, as well as the purpose of teacher record-keeping, a management system governs access to the programs on the disk.

Each time the disk is booted, the student will be asked to type his/her first and last names.

If the computer, having checked the records kept on the disk, determines that the student has not done the first program, or has achieved a score of less than the current mastery level on the first program, then s/he will be sent automatically to the first program on the disk.

Until such time as a student signing on has successfully completed every program on the disk, the computer will continue to prescribe the lessons to be done, in sequence.

Each time a student has unsuccessfully (scoring less than the current mastery level on the final review) completed a program, s/he will be offered the choice of repeating the program immediately. If the student chooses not to repeat the program at this time, when s/he returns to the program and enters first and last names, that same program will automatically display.

If a student has successfully completed a program, s/he will be given the option of going on to the next program immediately. Again, this next program will automatically display the next time the student signs on.

When a student has successfully completed all programs on the disk, s/he may wish to go back and review a particular program, or you may wish to have him/her do that. When that student signs on, the computer, after checking the files, will send him/her to a menu to select that program which s/he wishes to repeat.

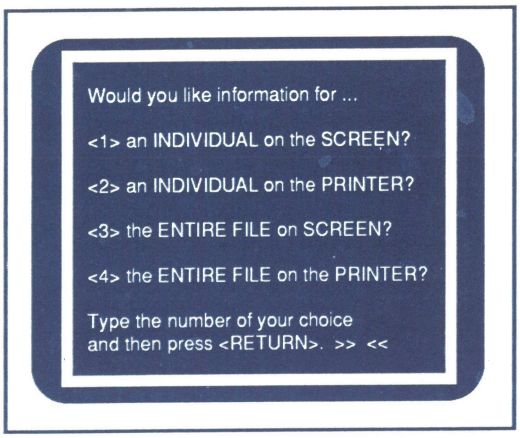
If a student who has completed all programs successfully chooses to repeat a particular program, and does so unsuccessfully, the next time that student signs on, s/he will be immediately directed to the same program, until such time as it is completed successfully.

Checking the Scores

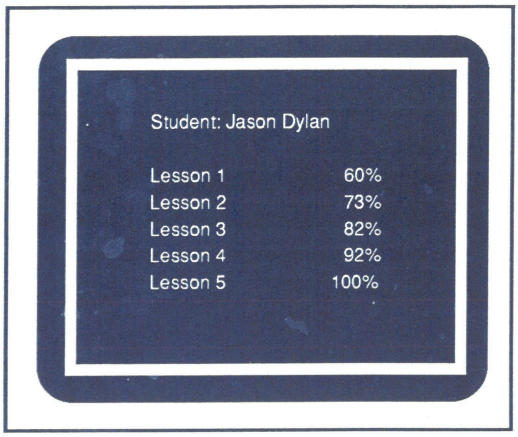
This disk contains a record of the students who have completed each program on the disk.

You may view these records by typing the command, **Scores**, when the computer displays, "Please type your first name and press <RETURN>."

The computer will then ask if you want a single student's file or the files on all students, and will also give the option of viewing these results on the screen or having them printed out if a printer is available.


Would you like information for ...
<1> an INDIVIDUAL on the SCREEN?
<2> an INDIVIDUAL on the PRINTER?
<3> the ENTIRE FILE on SCREEN?
<4> the ENTIRE FILE on the PRINTER?
Type the number of your choice
and then press <RETURN>. >> <<

Once these options have been decided upon, the following information will display: (1) the name of the student; (2) the programs on that disk; and (3) the most recent percentage score attained for each program.



As many as 75 students may be maintained on this disk.

Purging the File

The command, **Purge**, typed in when the computer asks, "Please type your first name and press <RETURN>," will give you the option to delete an individual student file or all student files on this disk.

The purge option can be used for a variety of situations.

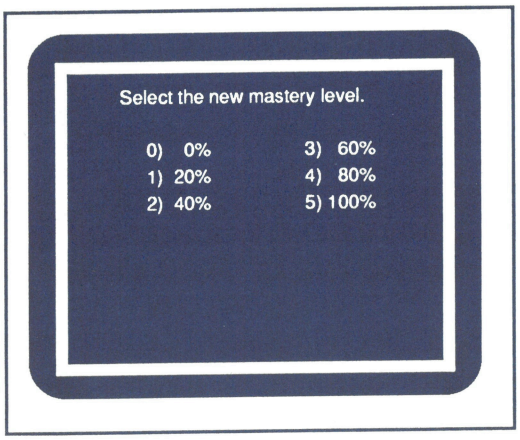
If a disk becomes full, a message will appear so you can utilize the purge option.

Scale Option

This program has been shipped with a *preset* passing grade of 60% for all programs contained on the disk.

If you wish to change this passing grade, type **Scale** when the computer asks, "Please type your first name and press <RETURN>."

You will then be told the current mastery level and asked if you wish to change it. If so, you'll be offered disk-specific choice of grades.



Once you've made your selection, you will be shown the *new* passing grade and asked if it is correct. If you've changed your mind, answer "N" (for no) and you'll be returned to the previous frame, where you may select a new grade.

Once the passing grade has been changed, it will remain on the disk *even after the computer has been turned off.* You may change it again at any time by repeating the procedure outlined above.

Note: If you set the mastery level at 0%, the program will no longer demand that the students do the lessons in a sequence, but rather will display the menu from which they may choose the programs they wish to do.

It is suggested that, if you are using this disk for the first time, you check it first to see what the mastery level is on the disk before assigning it to your students.

Teacher Option

This disk contains a special option that will allow the teacher direct access to the program menu and, consequently, all lessons on the disk. If you type **Teacher** when the computer asks, "Please type your first name and press <RETURN>," you will be sent to the menu where you can select whichever program(s) you wish to see.

Using this option bypasses the regular record-keeping function of the management system, so any scores obtained on these lessons will NOT be stored on the disk.

If you wish to quit a lesson at any time, holding down the CONTROL key and pressing the C key at the same time will return you to the name input frame at the beginning of the program.

SUPPLEMENTAL ACTIVITY WORKSHEETS

The reproducible activity worksheets included with the disk are designed to be used by students after completion of a program on the computer. These serve to further reinforce, and in some cases to extend, the student's understanding of the subject matter covered. You may choose to assign these sheets for individualized seat-work (after a student's computer time is over), or as homework. It is suggested that the sheets be assigned while the student's computer experience is still fresh in his/her mind in order to gain maximum effectiveness from them.

SUPPORT MATERIALS

Additional computer materials which also cover this subject are:

GEOMETRY ALIVE!
by Jason A. Dylan

This series demonstrates the principles of geometry in a way that is easily understandable.

DK-20021 - FUNDAMENTALS OF GEOMETRY
Build vocabulary and comprehension of basic geometric terms and forms such as: points, rays, lines, segments, parallels, angles, triangles, and quadrilaterals. The program also includes various types of angles and modifying quadrilaterals to produce trapezoids, parallelograms, rhombi, rectangles, and squares.

DK-20022 - AREAS OF TRIANGLES AND QUADRILATERALS
Find the areas of: triangles, rectangles, squares, parallelograms, and trapezoids. Reviews provide an unlimited supply of randomly generated problems.

DK-20023 - CIRCLES
Covers virtually all aspects of angles, lines, and segments connected with circles. Definitions include radius, diameter, and circumference. Pi is defined, and formulas for finding the circumference and areas of circles are worked with.

Each unit consists of 1 DISKETTE, 1 BACK-UP, MANAGEMENT, DOCUMENTATION, Reproducible Activity MASTERS (specify DK# and model)

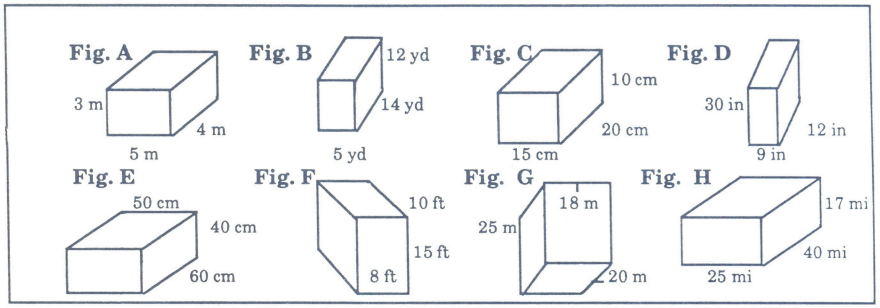
DK-GEOM - Complete series of 3 DISKETTES, 3 BACK-UPS, MANAGEMENT, DOCUMENTATION, Reproducible Activity MASTERS (specify model)

SUPPORT SERVICES

If you need immediate help with any EA microcomputer program, dial our toll free number, 800-645-3739 (in New York State, 516-223-4666). Ask for our CUSTOMER SERVICE DEPARTMENT.

CUBES, PRISMS, AND CYLINDERS

2. Rectangular Prisms



I. Find the surface area of each rectangular prism in the box above. Write your answers on the lines provided below.

Fig. A *94 m²* Fig. B *596 yd²* Fig. C *1,300 cm²* Fig. D *1,476 in²*
Fig. E *14,800 cm²* Fig. F *700 ft²* Fig. G *2,620 m²* Fig. H *4,210 mi²*

II. Find the volume of each of the rectangular prisms in the box above. Be sure to include the appropriate units when writing your answers on the lines provided below.

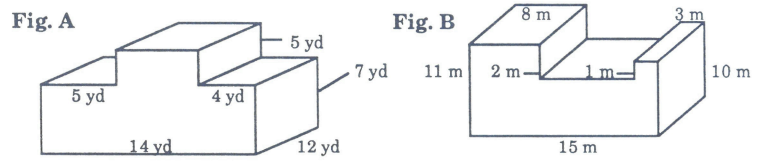
Fig. A *60 m³* Fig. B *840 yd³* Fig. C *3,000 cm³* Fig. D *3,240 in³*
Fig. E *120,000 cm³* Fig. F *1,200 ft³* Fig. G *9,000 m³* Fig. H *17,000 mi³*

III. CHALLENGE: Find the volume of each of the figures below. (Hint — Each figure is constructed of rectangular prisms.)

Fig. A *1,476 yd³* Fig. B *1,540 m³*

IV. Find the surface area of each of the two figures.

Fig. A *870 yd²* Fig. B *848 m²*



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CUBES, PRISMS, AND CYLINDERS

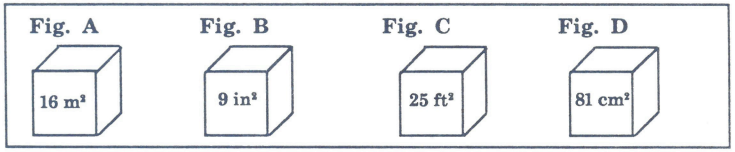
1. Cubes

I. Find the surface area of a cube with the sides specified below. Write your answers on the lines provided.

1) 2 m *24 m²* 2) 5 in *150 in²* 3) 1 km *6 km²* 4) 10 yd *600 yd²* 5) 15 cm *1,350 cm²*

II. Find the volume of each of the cubes in Question I above. Write your answers on the lines provided.

1) *8 m³* 2) *125 in³* 3) *1 km³* 4) *1,000 yd³* 5) *3,375 cm³*



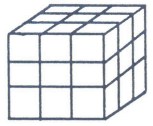
III. Using the figures in the box above, find the surface area of each of those cubes. Write your answers on the lines provided.

Fig. A *96 m²* Fig. B *54 in²* Fig. C *150 ft²* Fig. D *486 cm²*

IV. Using the figures in the box above, find the volume of each of the cubes. Write your answers on the lines provided.

Fig. A *64 m³* Fig. B *27 in³* Fig. C *125 ft³* Fig. D *729 cm³*

V.



Many small cubes were glued together to form the large cube at the left. The large cube was then painted all over the outside (including the bottom). Once the paint dries, the small cubes will be separated.

How many small cubes will have paint on...
1) 0 faces? *1*
2) 1 face only? *6*
3) exactly 2 faces? *12*
4) exactly 3 faces? *8*

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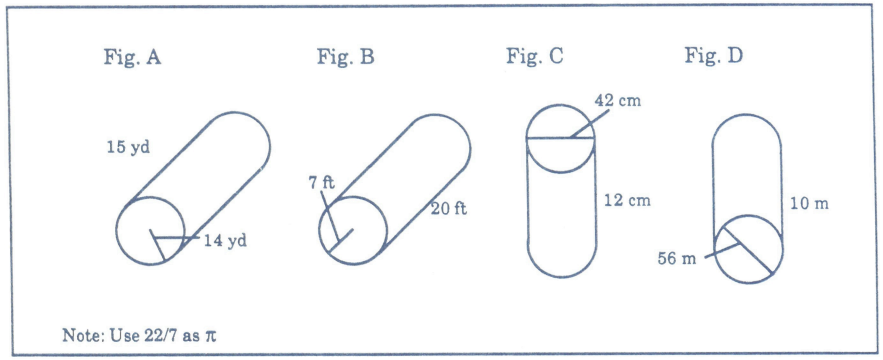
CUBES, PRISMS, AND CYLINDERS

4. Cylinders



Note: Use 22/7 as π

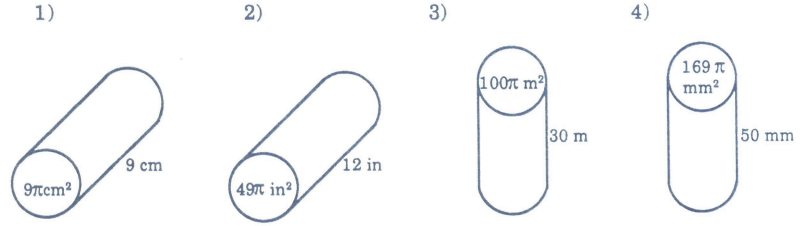
I. Find the surface area of each of the cylinders in the box above. Write your answers on the lines provided below.

Fig. A 3,872 yd² Fig. B 1,188 ft² Fig. C 4,356 cm² Fig. D 6,688 m²

II. Find the volume of each of the cylinders in the box above. Be sure to include the appropriate units when writing your answers on the lines provided below.

Fig. A 9,240 yd³ Fig. B 3,080 ft³ Fig. C 16,632 cm³ Fig. D 24,640 m³

III. The area of the base of each of the cylinders below is marked in terms of pi. Find the volume and surface area of each cylinder. Express your answers in terms of pi.



Volume 81π cm³ Volume 588π in³ Volume 3,000π m³ Volume 8,450π mm³
S. A. 72π cm² S. A. 266π in² S. A. 800π m² S. A. 1,638π mm²

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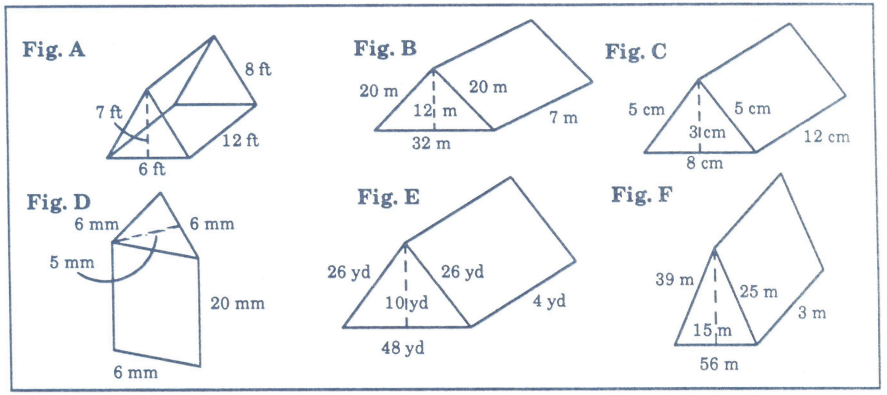
CUBES, PRISMS, AND CYLINDERS

3. Triangular Prisms



I. Find the surface area of each triangular prism in the box above. Write your answers on the lines provided below.

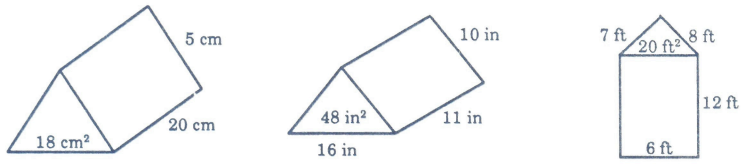
Fig. A 306 ft² Fig. B 888 m² Fig. C 240 cm²
Fig. D 390 mm² Fig. E 880 yd² Fig. F 660 m²

II. Find the volume of each of the triangular prisms in the box above. Be sure to include the appropriate units when writing your answers on the lines provided below.

Fig. A 252 ft³ Fig. B 1,344 m³ Fig. C 144 cm³
Fig. D 300 mm³ Fig. E 960 yd³ Fig. F 1,260 m³

III. The area of the triangular base of each of the prisms below is marked. Find each prism's volume.

Fig. A 360 cm³ Fig. B 528 in³ Fig. C 240 ft³



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CUBES, PRISMS, AND CYLINDERS

5. Mixed Practice

Fig. A

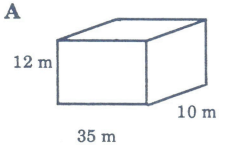


Fig. B

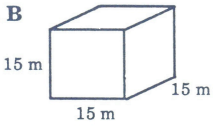


Fig. C

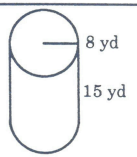


Fig. D

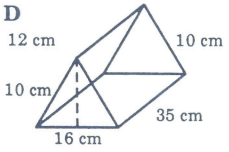


Fig. E

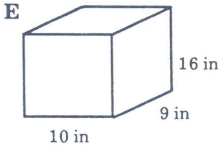


Fig. F

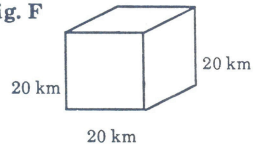


Fig. G

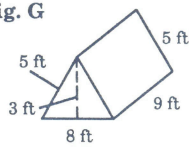


Fig. H

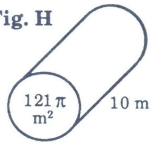
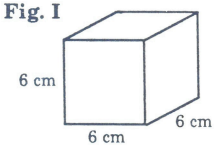


Fig. I



I. Find the volume of each of the figures in the box above. Write your answers on the lines provided below. (The answers for figures C and H may be expressed in terms of pi.)

Fig. A 4,200 m^3 Fig. B 3,375 m^3 Fig. C 960π yd^3
Fig. D 3,360 cm^3 Fig. E 1,440 in^3 Fig. F 8,000 km^3
Fig. G 108 ft^3 Fig. H 1,210π m^3 Fig. I 216 cm^3

II. Find the surface area of each of the figures in the box above. Write your answers on the lines provided below. (The answers for figures C and H may be expressed in terms of pi.)

Fig. A 1,780 m^2 Fig. B 1,350 m^2 Fig. C 368π yd^2
Fig. D 1,452 cm^2 Fig. E 788 in^2 Fig. F 2,400 km^2
Fig. G 186 ft^2 Fig. H 462π m^2 Fig. I 216 cm^2

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CUBES, PRISMS, AND CYLINDERS

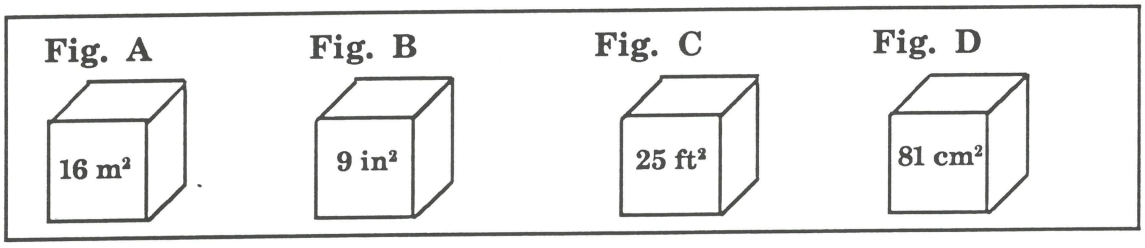
1. Cubes

I. Find the surface area of a cube with the sides specified below. Write your answers on the lines provided.

1) 2 m _____ 2) 5 in _____ 3) 1 km _____ 4) 10 yd _____ 5) 15 cm _____

II. Find the volume of each of the cubes in Question I above. Write your answers on the lines provided.

1) _____ 2) _____ 3) _____ 4) _____ 5) _____



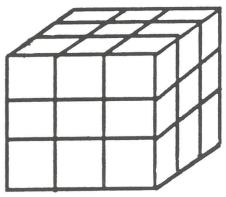
III. Using the figures in the box above, find the surface area of each of those cubes. Write your answers on the lines provided.

Fig. A _____ Fig. B _____ Fig. C _____ Fig. D _____

IV. Using the figures in the box above, find the volume of each of the cubes. Write your answers on the lines provided.

Fig. A _____ Fig. B _____ Fig. C _____ Fig. D _____

V.



Many small cubes were glued together to form the large cube at the left. The large cube was then painted all over the outside (including the bottom). Once the paint dries, the small cubes will be separated.

How many small cubes will have paint on...

1) 0 faces? _____
2) 1 face only? _____
3) exactly 2 faces? _____
4) exactly 3 faces? _____

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CUBES, PRISMS, AND CYLINDERS
2. Rectangular Prisms

Fig. A

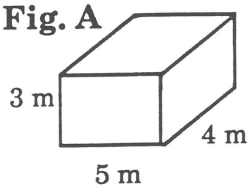


Fig. B

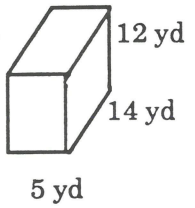


Fig. C

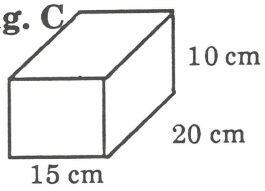


Fig. D

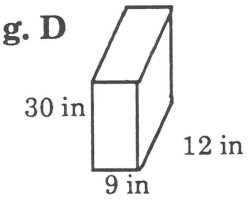


Fig. E

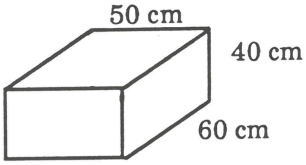


Fig. F

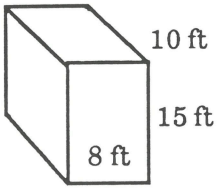


Fig. G

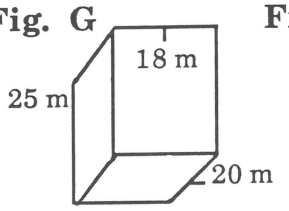
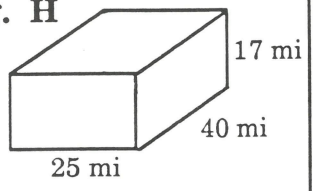


Fig. H



I. Find the surface area of each rectangular prism in the box above. Write your answers on the lines provided below.

Fig. A _____ Fig. B _____ Fig. C _____ Fig. D _____
Fig. E _____ Fig. F _____ Fig. G _____ Fig. H _____

II. Find the volume of each of the rectangular prisms in the box above. Be sure to include the appropriate units when writing your answers on the lines provided below.

Fig. A _____ Fig. B _____ Fig. C _____ Fig. D _____
Fig. E _____ Fig. F _____ Fig. G _____ Fig. H _____

III. CHALLENGE: Find the volume of each of the figures below. (Hint — Each figure is constructed of rectangular prisms.)

Fig. A _____ Fig. B _____

IV. Find the surface area of each of the two figures.

Fig. A _____ Fig. B _____

Fig. A

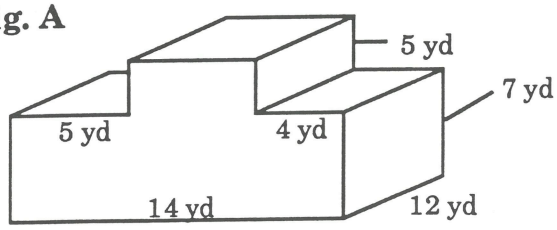
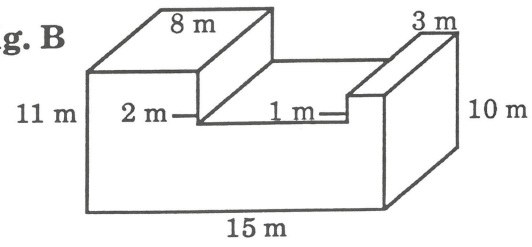


Fig. B



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CUBES, PRISMS, AND CYLINDERS

3. Triangular Prisms

Fig. A

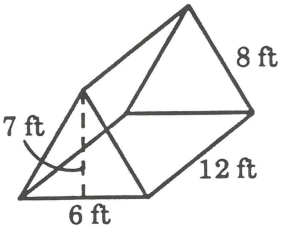


Fig. B

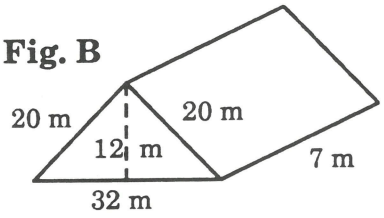


Fig. C

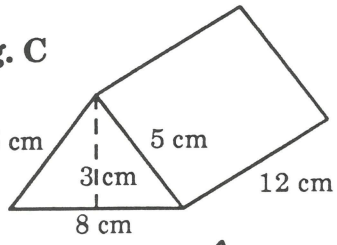


Fig. D

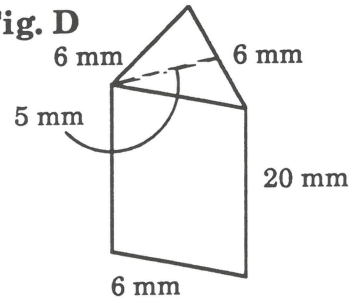


Fig. E

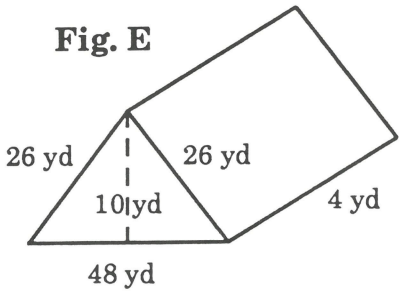
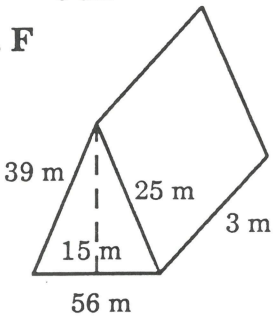


Fig. F



I. Find the surface area of each triangular prism in the box above. Write your answers on the lines provided below.

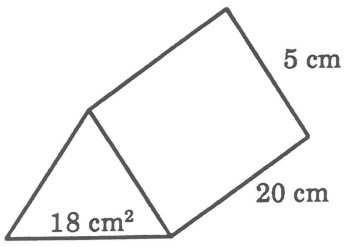
Fig. A _____ Fig. B _____ Fig. C _____
Fig. D _____ Fig. E _____ Fig. F _____

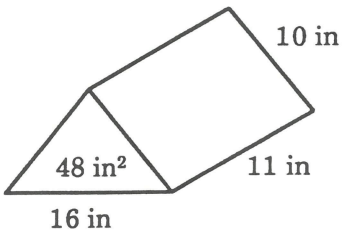
II. Find the volume of each of the triangular prisms in the box above. Be sure to include the appropriate units when writing your answers on the lines provided below.

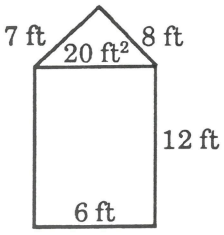
Fig. A _____ Fig. B _____ Fig. C _____
Fig. D _____ Fig. E _____ Fig. F _____

III. The area of the triangular base of each of the prisms below is marked. Find each prism's volume.

Fig. A _____ Fig. B _____ Fig. C _____







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CUBES, PRISMS, AND CYLINDERS
4. Cylinders

Fig. A

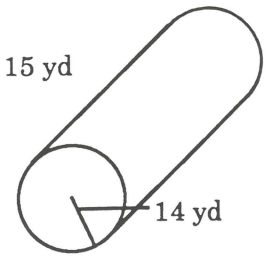


Fig. B

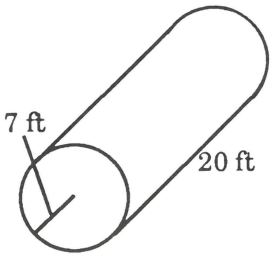


Fig. C

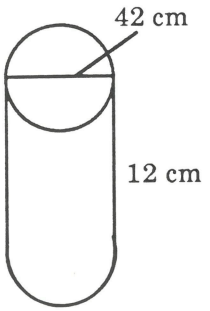
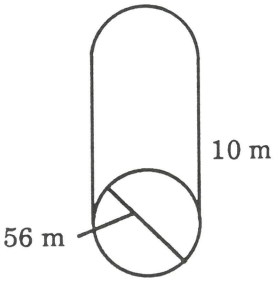


Fig. D



Note: Use 22/7 as π

I. Find the surface area of each of the cylinders in the box above. Write your answers on the lines provided below.

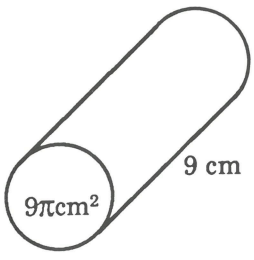
Fig. A _____ Fig. B _____ Fig. C _____ Fig. D _____

II. Find the volume of each of the cylinders in the box above. Be sure to include the appropriate units when writing your answers on the lines provided below.

Fig. A _____ Fig. B _____ Fig. C _____ Fig. D _____

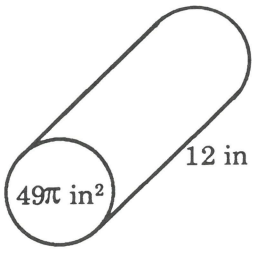
III. The area of the base of each of the cylinders below is marked in terms of pi. Find the volume and surface area of each cylinder. Express your answers in terms of pi.

1)



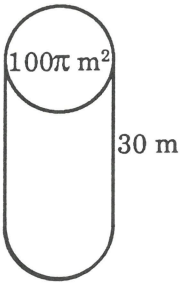
Volume_____
S. A. _____

2)



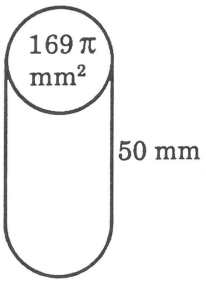
Volume_____
S. A. _____

3)



Volume_____
S. A. _____

4)



Volume_____
S. A. _____

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CUBES, PRISMS, AND CYLINDERS

5. Mixed Practice

Fig. A

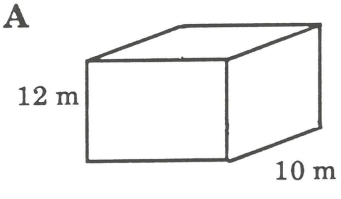


Fig. B

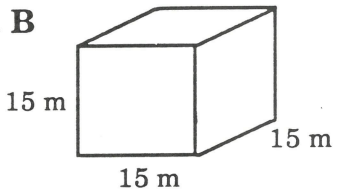


Fig. C

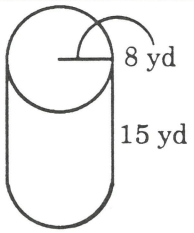


Fig. D

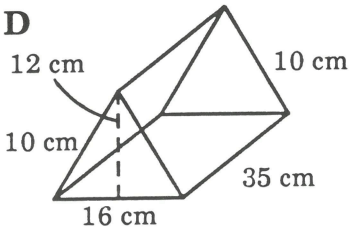


Fig. E

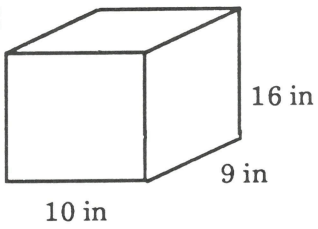


Fig. F

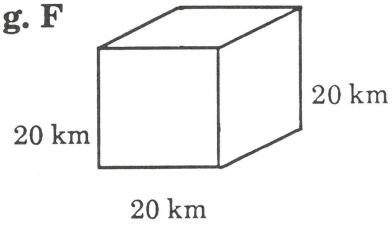


Fig. G

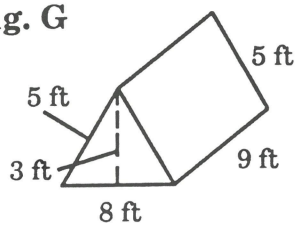


Fig. H

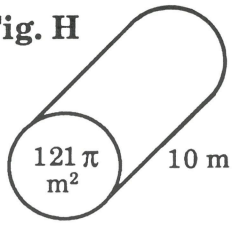
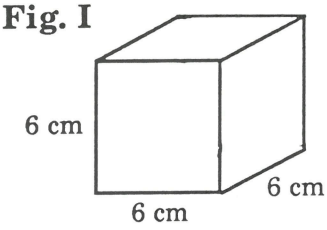


Fig. I



I. Find the volume of each of the figures in the box above. Write your answers on the lines provided below. (The answers for figures C and H may be expressed in terms of pi.)

Fig. A _____ Fig. B _____ Fig. C _____
Fig. D _____ Fig. E _____ Fig. F _____
Fig. G _____ Fig. H _____ Fig. I _____

II. Find the surface area of each of the figures in the box above. Write your answers on the lines provided below. (The answers for figures C and H may be expressed in terms of pi.)

Fig. A _____ Fig. B _____ Fig. C _____
Fig. D _____ Fig. E _____ Fig. F _____
Fig. G _____ Fig. H _____ Fig. I _____

Name _____ Class_____ Date_____

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FREEPORT, NY 11520

Instructions for Operating Your APPLE II® Disk Program

1. Insert the disk into the Drive. Use Drive I when two drives are present.

2. Turn on the computer and the monitor and wait until the IN USE light on the Drive goes off.

3. The program will execute and A will be displayed. If this doesn't appear, restart the procedure.

4. After the introductory remarks have been displayed, the PROGRAM MENU will appear on the screen. Select the program you wish by following the instructions on the screen. (Single program diskettes do not contain a MENU.)

5. If you would like to stop in the middle of a program, press the CTRL key and the "C" key simultaneously, then press RETURN. This will bring you back to the PROGRAM MENU.

6. To return to the introductory remarks, press the CTRL key and the RESET key simultaneously.

7. If you wish to use a different disk, place it in the Drive and press the CTRL key and the RESET key simultaneously.

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